Georgia. Dept. of public
health.
Water supplies for sub-
urban country homes.

WATER SUPPLIES for SUBURBAN and COUNTRY HOMES

Georgia Department of Public Health

Atlanta, Ga. March, 1941

WATER SUPPLIES FOR SUBURBAN AND COUNTRY HOMES

PART I

GENERAL

This bulletin deals with water supplies for the individual home. However, the fact should be stressed that it is unwise and usually not economical to develop individual wells or springs when water from a city or public supply is available. The safety of sterilization and the convenience of water delivered to your home under pressure, at any time day or night without interruption, cannot be built into a private water supply without making the cost prohibitive. Furthermore, the public supply has been developed by engineers familiar with this type of work. They have studied local conditions and have taken all precautions to safeguard the purity of the water pumped to the consumers. Public supplies are usually operated by men who have been given special training in water purification and the quality of water produced is checked at frequent intervals by laboratory tests in the water plants and by the State Department of Health.

Everyone should realize the importance of an ample supply of good water in the home. Water is more generally used than any other single commodity and is absolutely essential to the health and physical comfort of human and animal life. The absence of satisfactory supplies of water has retarded the growth and development of many parts of the country. Several cities have spent millions of dollars to secure water from points hundred of miles away. Most sections of Georgia are fortunate in this respect as an ample quantity of water usually can be secured at a reasonable cost. This is especially true in the case of the individual rural homes where water is obtained from wells or springs. Unfortunately, however, water obtained from such sources is not always pure and in some instances may be dangerously polluted.

A water may be very clear, cool and free of objectionable tastes and odors, yet contain sufficient bacteria of certain kinds to render it extremely dangerous for human consumption. To be satisfactory for domestic purposes a water should be free at all times from any bacteria capable of causing disease; should be clear and free of unpleasant tastes and odors; and should not contain excessive amounts of dissolved minerals.

The use of impure or polluted water from springs and wells has been the cause of many cases of illness, such as typhoid and dysentery. Much of this could have been prevented if reasonable precautions had been taken in locating and constructing the water supply.

Per Cent of Georgia Population Using Water from
Different Sources 1941

Source of Water Used	Per Cent Population Using
Public Supplies from Surface Waters Receiving Filtration and Sterilization	25.9
Public Supplies from Wells and Springs Receiving Sterilization	10.7
Public Supplies from Wells and Springs Not Sterilized	5.7
Water from Home Wells and Springs in Rural Areas or Small Towns Having No Public Water Supply	57.7

THE SOURCE OF WATER OBTAINED FROM WELLS OR SPRINGS

All water obtained from wells or springs has previously fallen upon the earth's surface in the form of rain or snow. When such water falls upon the earth some runs off into streams and finally into lakes or oceans; some evaporates into the air; and some seeps into the ground where it accumulates in the porous materials forming the earth's crust and fills the cracks and crevices of the underlying rocks. Water thus stored in the earth, sometimes called 'Ground Water', moves very slowly toward deep ravines or valleys and in the general direction of the coasts.

Sometimes the porous materials in the underlying formations become saturated with water to a point where, in low areas, the water flows out on the surface forming springs.

When the ground water does not extend to the surface it can be obtained in most locations by sinking a well of sufficient depth to reach the point where the water has accumulated. If the well penetrates layers of porous materials such as sand, gravel or highly shattered and creviced rock usually water will be obtained if the well is sunk to a sufficient depth. On the other hand, often there may be times when no water at all will be obtained if a well is drilled in a dense rock formation which is free of cracks and crevices.

GROUND WATER IS NOT ALWAYS PURE

Water obtained from wells or springs is often impure or polluted. The rain water which falls upon the earth is quite pure, but upon reaching the ground it begins to accumulate foreign material of numerous kinds including many types of bacteria from various sources and minerals dissolved from the soil, clay and rock. The bacteria are much more dangerous, from the standpoint of health, than are the minerals.

HOW GROUND WATER MAY BECOME POLLUTED

The most dangerous bacteria for a water to contain are those which come from the body discharges of animals, especially *humans*. Such bacteria enter a water supply in many ways, some of the most common of which are:

By surface water flooding the top or seeping in near the top of a well or spring.

By seepage from privies, cesspools, sewers, septic tanks, stables, etc., flowing into the underground water through porous soil, gravel or cracks in rock formations.

By carelessly tracking filth over a poorly covered well, spring or reservoir.

By handling a well rope, chain or bucket with dirty hands.

DISEASES MAY BE CAUSED BY DRINKING POLLUTED WATER

The diseases most commonly caused by polluted water are typhoid, para-typhoid, dysenteries and diarrheas. These are sometimes called 'diseases of the intestinal tract.' The bacteria causing them are present in large numbers in the intestines of persons suffering from these diseases and pass from their bodies in the urine and bowel discharges, sometimes in enormous numbers. Often a person will continue to discharge these bacteria for weeks after he is apparently well. Occasionally such a person will discharge the bacteria for years after having recovered from the disease. Such persons are called *Carriers*. They may never suspect that they harbor millions of deadly bacteria.

It is believed that polluted water is sometimes responsible for the transmission of certain parasitic worms, such as the round worm, pin worm and whip worm. In countries where cholera is prevalent this is often transmitted by impure water.

Drinking polluted water, however, is only one of several ways the above mentioned diseases may be transmitted. Any method by which these bacteria find their way from the bowel discharges of patients or carriers into something other persons eat or drink may be responsible for the spread of the disease.

HOW CAN A PERSON KNOW IF A WATER SUPPLY IS SUFFICIENTLY PURE TO BE SAFE?

1. By making a very careful inspection of the source of the supply, noting everything in its vicinity, particularly on any ground above the supply. The following question should be answered yes or no: It is possible for any animal, and especially human, wastes or anything which may have come in contact with such wastes to get into the water supply? If the inspection has been thoroughly made and the answer to this question is *no* then the water may be safe. If the answer is *yes* then the water is dangerous, even though it has caused no illness in the past. A careful survey, in many cases, will reveal all the information necessary for determining the probable safety of a well or spring. Points to be considered in making this survey are discussed on page 9.

2. Following the inspection of the water supply, and provided there is no obvious possibility for pollution, the quality of the water can be checked by bacteriological tests. The laboratory tests should be done only after all known possibilities of pollution have been corrected. For instance, bacteriological tests would tell no more than is already known in a case where it can be seen that surface water is seeping in near the top of a dug well or running into a spring basin, or where the water becomes muddy after rains. Where a rope and bucket are used in a well it is known that pollution will be introduced into the well through handling the rope and bucket.

Under the above conditions it would be impossible to determine by laboratory tests the purity of the underground water until these obvious methods of pollution have been eliminated. Fortunately, pollution of this nature does not always cause disease. Yet there is the constant danger of some disease carrier infecting the water when the source is not protected from such pollution.

Water from surface streams is almost always impure, and should never be used for drinking purposes without careful purification and sterilization, which is impractical for home water supplies.

The old idea that flowing water purifies itself every few hundred feet is entirely false.

CAN LABORATORY TESTS DETERMINE THE PRESENCE OF DISEASE-PRODUCING BACTERIA IN WATER?

Usually it is impractical to try to find disease-producing bacteria when testing the purity of drinking water. The reasons for this are briefly as follows:

In the first place, no satisfactory test is known whereby a laboratory can readily determine the presence in water of such bacteria as those causing typhoid, dysentery, etc. On the other hand, we wish to know if it is possible for such bacteria to get into a water supply *before* they actually do so and *before* someone has consumed water containing them.

To establish this fact the laboratory looks for evidence of pollution by fecal matter or sewage rather than for the specific disease-producing bacteria. Sewage may contain disease-producing bacteria. As has been stated before such bacteria originate in the intestines of humans and are discharged in the body wastes. Therefore, if body excreta or anything coming in contact with such material can get into a water, then disease bacteria can enter also; if neither body excreta nor anything which has been in contact with excreta can get into the water, then disease bacteria will be absent and the water will be safe.

The laboratory tests, used in establishing the quality of water, are for a group of bacteria which are present in all fecal matter, and for which there is a very well known and delicate test. These bacteria are known as the Coliform group.

POINTS TO BE CONSIDERED IN MAKING AN INSPECTION OF A WELL OR SPRING

1. The location, distance from, and direction of drainage of all possible sources of pollution in the vicinity.

2. The method by which the well or spring is protected to prevent contamination directly into the top. Waste Water should not spill around the top of the well.

3. The nature of the soil, clay or rock through which the underground water must travel.

4. If a well, its depth and the depth of casing.

5. Is natural drainage away from the well or spring?

6. Is it subject to flooding during heavy rains?

The cleanliness in the general vicinity of a well or spring is most important. This is especially true in the case of dug wells and surface springs. The distance from sources of pollution, such as laundry tubs, cesspools, septic tanks, privies, sewers, stables, etc., should be as great as possible. None of these should be on ground directly above a water supply, but should be located at lower elevations where they will drain away from the water supply. Usually the movement of the underground water is in the same general direction as the surface drainage.

No set rule can be given for a safe distance between a water supply and some source of pollution, such as a privy. It is thought that this should never be less than 100 feet and then only where ideal soil conditions exist and where the pollution is at a much lower elevation than the well or spring.

Nearby abandoned wells or other holes or cuts where surface water may find its way through the top soil or clay into underground water channels are undesirable and may cause trouble. Under no condition should abandoned wells be utilized for domestic sewage disposal.

Top - Hand pump over dug well. Note ground slopes away from well in all directions. Wooden trough collects waste water which is piped to barn for watering stock.
Bottom - Spring protected from direct surface contamination by concrete basin and retaining wall.

The nature of the clay, sand or rock through which the water must travel and from which it is obtained should be observed. Water which must filter through many feet of tight clay or fine sand will receive a much higher degree of purification than water passing through a coarser material such as gravel or disintegrated rock.

If layers of creviced rock come up to or near the ground surface, dangerous pollution may enter the underground water through seams or cracks in this rock. In soft limestone regions, such as are found in some of the counties in the Coastal Plain Section and in the extreme Northwest Section of the State, vast underground channels and caverns are prevalent. These often carry highly polluted water for miles in much the same manner as if it were flowing through pipes, and with very little or no purification of the water as it passes underground. Wells and springs in such areas may be dangerous!

The depth at which well water is obtained frequently affects its quality. In many places water may be found only a few feet below the surface. Such water usually has not received sufficient filtration to free it from surface pollution. Under such conditions dug wells are frequently unsatisfactory, and it is probable that a better quality of water could be obtained by drilling the well to a greater depth and shutting off the top layers of polluted water by means of a watertight casing. Such a casing should extend well below the zone affected by surface seepage.

Good natural drainage away from a well or spring will help in preventing pollution as the surface water will flow away from the supply washing surface pollution with it. On the other hand, depressions, pits, lime sinks or any ponded surface water in the vicinity of a water supply will tend to concentrate surface pollution and increase the chances of this penetrating to the underground water.

A drinking water supply should not be located at a point so low that it may be covered by flood waters. Springs, near ravines or streams which are subject to flooding, should not be used. Wells located near water courses where layers of underground rock are exposed, frequently receive surface water through crevices in such rock.

PART II

CONSTRUCTION METHODS

WELLS

There are three types of wells in general use. These are dug wells, driven wells and drilled wells.

DUG WELLS - Dug wells which are from 3 to 4 feet in diameter are commonly used in clay and loose rock formations. As a rule they do not yield a large volume of water. Such wells, which are rarely more than 80 to 100 feet deep, are sunk to a point slightly below the level of the accumulated ground water. Often in some parts of the State small trickles of water will be found near the upper levels of the underground rock formations and if the well hole is dug or blasted a few feet into this rock these small flows will be collected in the reservoir thus formed.

Dug wells should be cased to prevent surface seepage from running directly down the sides. They should be protected at the ground surface with a watertight curb carried sufficiently above and below the ground level to shut off surface water and a watertight cover provided.

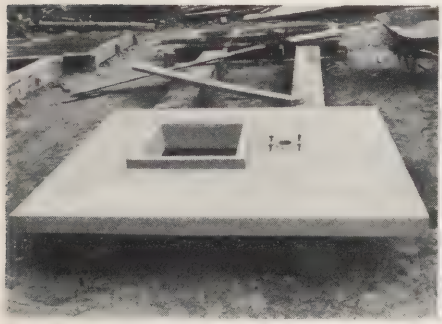
Concrete or terra cotta pipe are ordinarily used for casing dug wells. The joints should be made as nearly watertight as possible by carefully caulking with a rich cement mortar. The space between the casing and earth wall should be back filled using clean gravel for about the first 10 feet above the bottom of the well. The distance from the top of the gravel to within about 6 feet of the surface should be filled with clean clay or sand and should be tamped or puddled as it is placed. The top few feet should be filled with concrete.

Under ideal conditions where there is no tendency for the well to cave and where the natural drainage is such that the sides of the well remain dry in rainy weather, indicating absence of surface seepage it may be permissible to eliminate the casing if the cost of this would prohibit the improvement of the well. However, if possible, the casing should be installed.

In many localities the water obtained from dug wells probably has not traveled very far underground but, following rains, entered the ground in the general vicinity of the well.

Dug wells frequently accumulate enough carbon dioxide gas to make it dangerous for a person to enter such a well. This gas is heavier than air and tends to collect in the bottom of a well forcing the lighter air upward. A person entering such a well is affected by lack of oxygen. Some method whereby air can be forced to the bottom of the well is necessary before such a well is safe to enter.

The carbon dioxide gas which dissolves in the water does not affect its quality from a health standpoint, however, such waters frequently have a very corrosive action on iron pipe, tanks, etc., causing rust to accumulate rapidly and rendering the water muddy or red. Such conditions can be corrected as described on page 32 under Corrosion Control.



Left - Precast concrete slab. Note raised lip around manhole and hole for drop pipe.

Right- Precast concrete slab in place over well with pump mounted.

Fig. 1

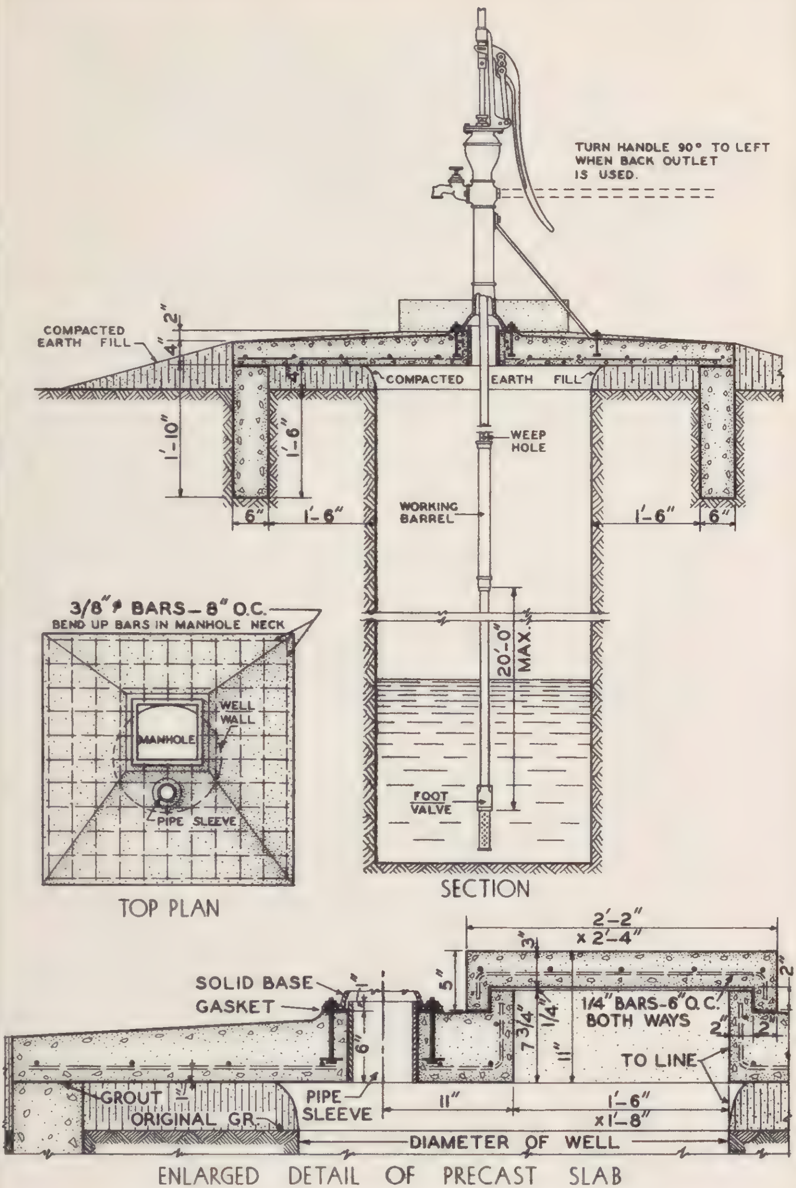
In Fig. 1 a hand pump is shown mounted on a precast concrete slab.

Where the well is dug through tight clay a hardpan usually will be found within 18 inches of the surface. A foundation wall entirely around the well and extending down into this hardpan is first constructed. This should be about 18 inches from the sides of the well at the closest points and should be finished off level at least 4 inches above the ground surface.

Forms for the cover slab are built on level ground as near the well as possible. The dimensions of the foundation wall and the diameter of the well should be checked so that the slab will fit and the manhole and pump opening will fall over the well. These forms must be supported sufficiently to carry the weight of the concrete without sagging, otherwise, an uneven and poor fitting cover will result.

Reinforcing rods as shown should be used and care should be taken in forming and placing reinforcing rods in the lip around the manhole. A template to fit the pump base should be used so that the bolts will be in their proper position and the pipe sleeve forming the hole for the drop pipe will be held true. This sleeve must be of such diameter and length that it will fit inside the pump base and extend slightly above the concrete slab. The manhole cover is to be constructed as shown in Fig. 2.

When the concrete has set sufficiently timbers are placed alongside the slab and foundation walls to act as a track and protect the foundation walls when moving the slab into place. The edge of the slab nearest the well is first raised with crowbars, after which rollers of pipe are placed underneath and the slab rolled into place.



CONSTRUCTION DETAILS FOR DUG WELLS
(PRECAST SLAB)
FIG. 1

Fig. 2

Fig. 2 is a suggested method by which the foundation walls and cover slab can be constructed in place and the forms removed after the concrete has hardened.

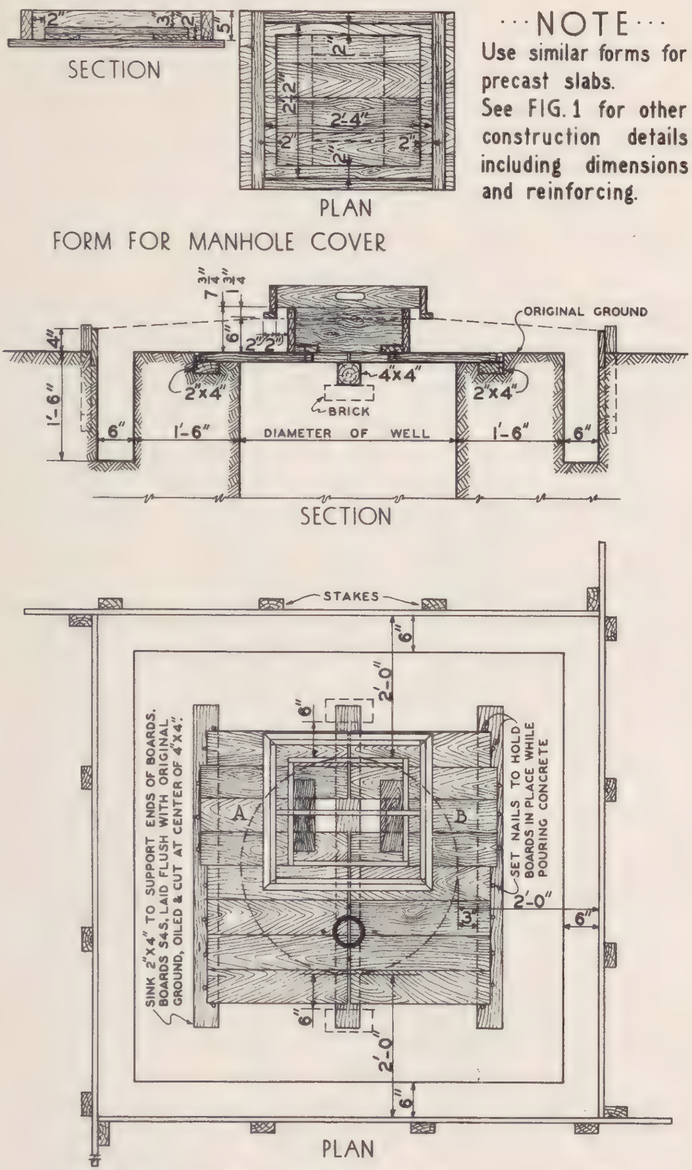
The trench for the foundation walls is dug as in Fig. 1.

A 4 x 4 is placed across the diameter of the well with each end resting on a brick about 6 inches from the sides of the well (or a sufficient distance to prevent caving) and sunk to a depth to bring the top of the 4 x 4 one inch below the ground level. A piece of 2 x 4 is placed in the ground on either side of the well. The top of these should be level with the 4 x 4. Dressed boards oiled and cut along the center of the 4 x 4 are laid over the well with ends resting on the 2 x 4s. Twenty penny nails driven into the 2 x 4s at the ends of each board will keep these from slipping while the concrete is being placed. Two boards near the center of the manhole (A & B) are cut short so that their ends nearest the center of the well fall just inside the manhole. These ends are supported by short boards laid crosswise which can later be removed through the manhole. Reinforcing rods are placed as shown in Fig. 1 and the same precautions as given there apply to forming the lip on the manhole and providing a template for the pump base.

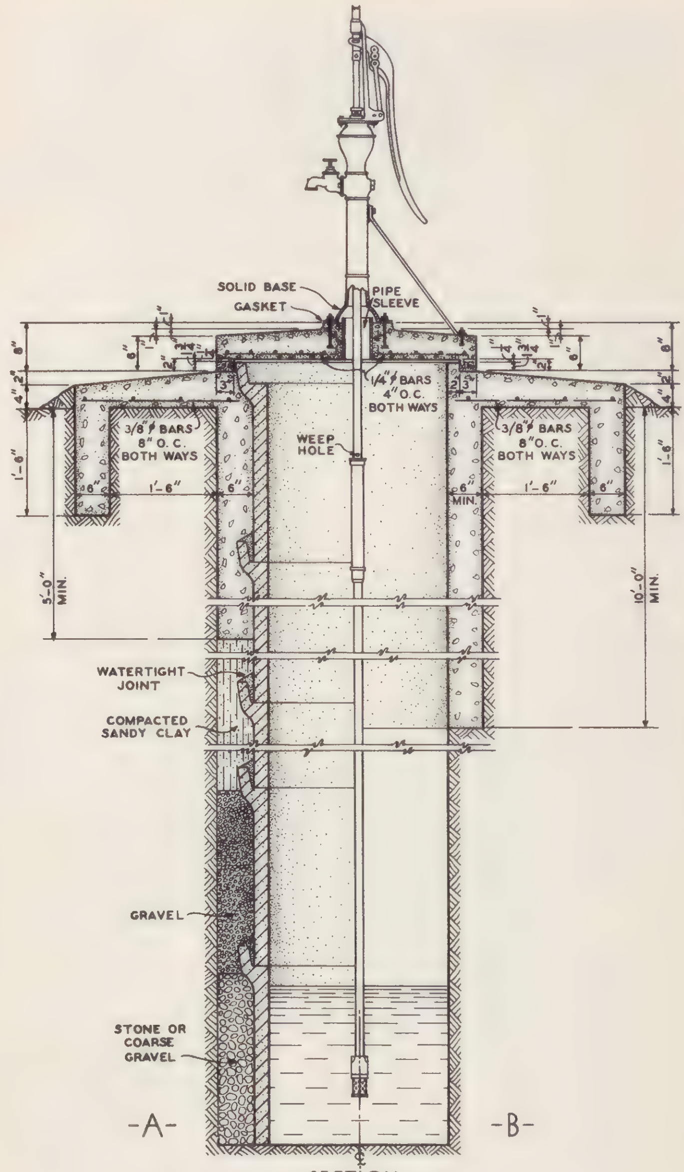
After the concrete has hardened the short pieces of boards (A & B) under the manhole are first removed. The 4 x 4 is then sawed through and the remaining boards worked around and removed through the manhole as are the pieces of 4 x 4. The two pieces of 2 x 4 on either side of the well are left in place.

···NOTE···

Use similar forms for precast slabs.
See FIG. 1 for other construction details including dimensions and reinforcing.



CONSTRUCTION DETAILS FOR DUG WELLS
(REMOVABLE FORMS FOR SLAB CAST IN PLACE)
FIG. 2



SECTION

CONSTRUCTION DETAILS FOR DUG WELLS
(LINED WELLS)
FIG. 3

Fig. 3

Fig. 3 shows suggested methods for lining dug wells. In A is shown the use of terra cotta or concrete pipe. The space between the earth wall and the well lining is filled with clean crushed stone or gravel to a point above the water level, then with sand or clay to a point not less than 5 feet from the surface. The remaining 5 or more feet are filled with concrete.

Joints in the lining should be filled with rich cement grout as they are placed. The pump as shown is mounted on the manhole cover, the dimensions of which will depend upon the diameter of the pipe used to line the well. The cover should be reinforced as shown.

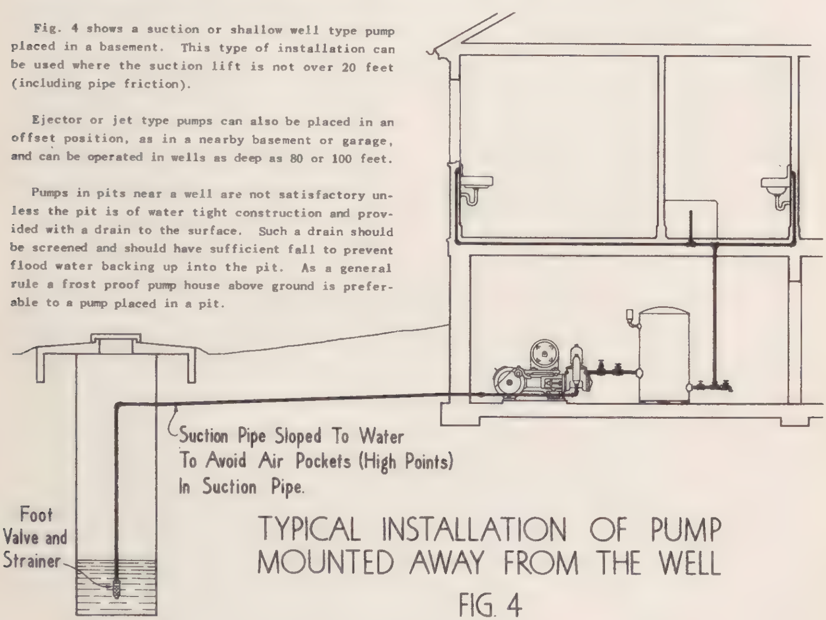
In B is shown the use of a concrete lining extending at least 10 feet into the well. This type of construction calls for special forms in order to secure a satisfactory job.

Where a power pump offset from the well is used suction lines should be laid before concrete is placed.

Fig. 4 shows a suction or shallow well type pump placed in a basement. This type of installation can be used where the suction lift is not over 20 feet (including pipe friction).

Ejector or jet type pumps can also be placed in an offset position, as in a nearby basement or garage, and can be operated in wells as deep as 80 or 100 feet.

Pumps in pits near a well are not satisfactory unless the pit is of water tight construction and provided with a drain to the surface. Such a drain should be screened and should have sufficient fall to prevent flood water backing up into the pit. As a general rule a frost proof pump house above ground is preferable to a pump placed in a pit.



TYPICAL INSTALLATION OF PUMP
MOUNTED AWAY FROM THE WELL

FIG. 4

DRIVEN WELLS - This type of well is used in sandy or loamy formations where the water table is fairly close to the surface. These wells are usually rather shallow and are constructed by driving a pointed pipe into the sand until the bottom of the pipe is some distance below the water table. The lower portion of this pipe is perforated or may have a strainer inserted for part of its length.

If the water table is within 20 feet of the surface a suction type pump is usually attached to the top of the pipe. When the water table is deeper than this a piston pump with working barrel must be inserted into the well.

Whatever type pump is used must be rigidly attached to the casing.

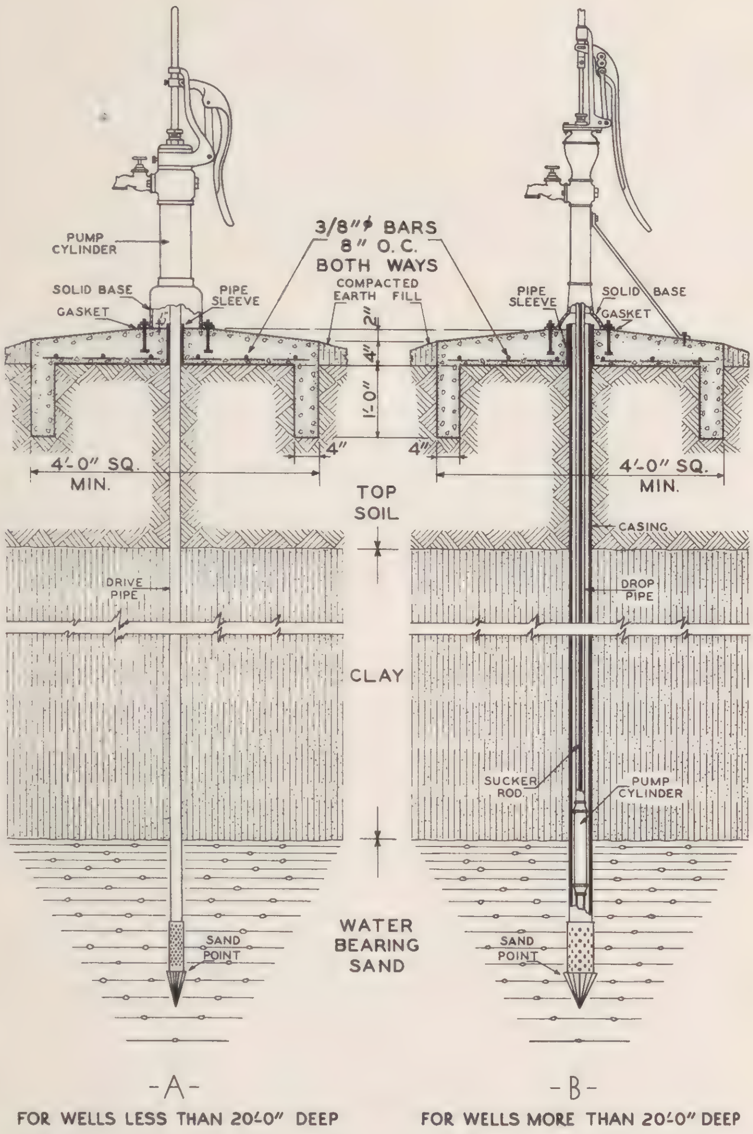
A concrete apron should be constructed around the top of such a well and a drain provided to carry waste water away from the immediate vicinity of the well.

Fig. 5

Fig. 5 shows suggested construction for driven wells. Where water bearing strata are within 20 feet of the surface type A may be used. The pump cylinder in this case is built into the pump.

If the water table is more than about 20 feet from the surface an outer casing must be driven or jetted down and a drop pipe and cylinder used inside the casing as shown in B.

Pitcher pumps are often used in wells less than 20 feet deep. These pumps are insanitary due to their open top and the fact that they require priming and are otherwise unsatis factory.



CONSTRUCTION DETAILS FOR DRIVEN WELLS

FIG. 5

DRILLED WELLS - Drilled wells can be constructed in any water bearing formation and can be extended much deeper than other type wells, consequently, they often afford greater yields. They can be cased with steel pipe for whatever depth necessary and if this casing is properly sealed surface water can be shut off and the danger of pollution lessened.

Methods for sealing a well casing are quite technical and in general a person having a well drilled must rely upon the ability and honesty of the well driller to secure a satisfactory job.

Drilled wells should be located with the same precautions as would be taken with dug wells and although the well may be several hundred feet deep it is still subject to contamination in some formations, especially in limestone regions.

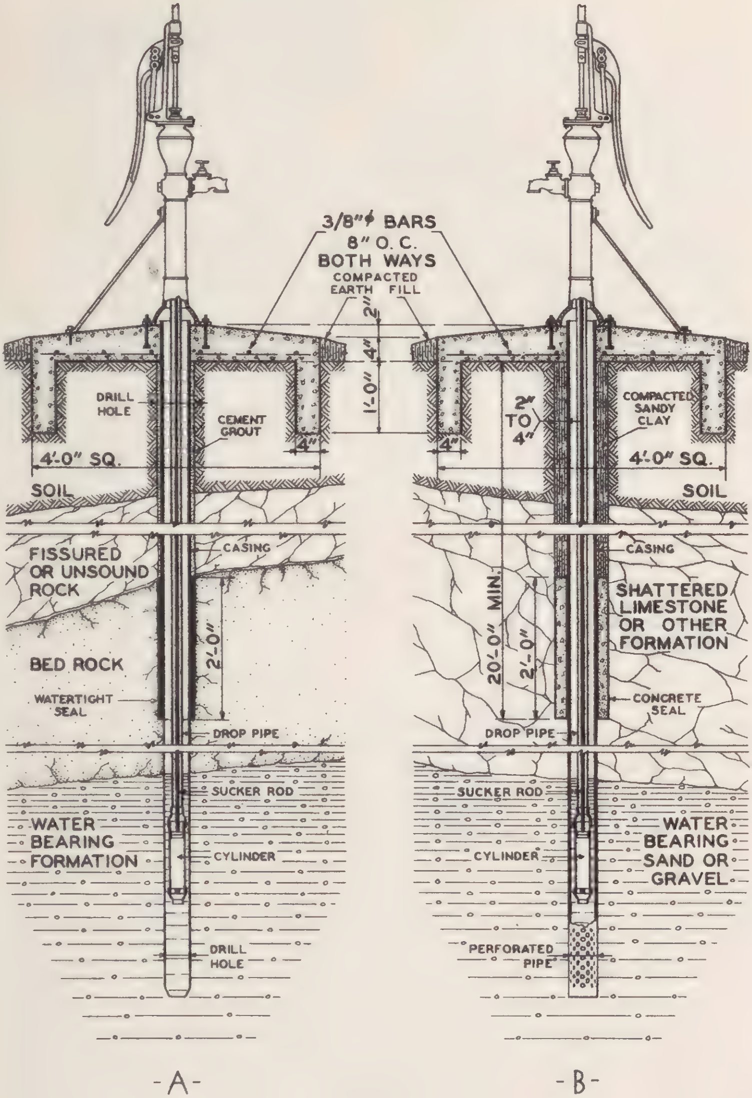
Many wells drilled in the crystalline formations of the Piedmont Plateau area have afforded little or no water. Expert geological opinion suggests that it is usually unwise to drill wells in this area deeper than from three to five hundred feet.

The well casing should be finished off at least 7 inches above the ground surface and a concrete pump base poured around this. When the pump is installed a watertight cap between the drop pipe and outer well casing is necessary.

Fig. 6

Fig. 6. A drilled well in rock formation is shown in A. Such wells are usually cased through the upper strata of clay and loose rock and into fairly solid material. Care should be exercised in sealing the bottom portion of the casing to shut off surface seepage. The casing should also extend above the original ground level and into the base of the pump.

B shows a drilled well in a formation of sand or gravel. The well is cased for its entire depth and a strainer inserted in the water bearing stratum. This strainer should have a minimum length of 4 feet.



CONSTRUCTION DETAILS FOR DRILLED WELLS
FIG. 6

SPRINGS

Springs of shallow origin fed by small seeps originating on ground immediately above the point of emergence may yield a water of about the same quality as dug wells in that area. These springs rarely afford more than a few gallons per minute. Deep seated springs where water from considerable depth reaches the surface through fissures in the rock may have a more remote origin and yield larger quantities of water. In limestone regions this may be highly contaminated.

Spring basins should be excavated sufficiently deep or back into the earth or rock to locate the main vein or veins around which a concrete collecting basin should be constructed. This ought to extend above the ground and have a tight fitting cover. An overflow pipe should be provided at the normal water level of the spring. *Do not attempt to make the water rise above this level as it may cause the spring to break out through crevices below.*

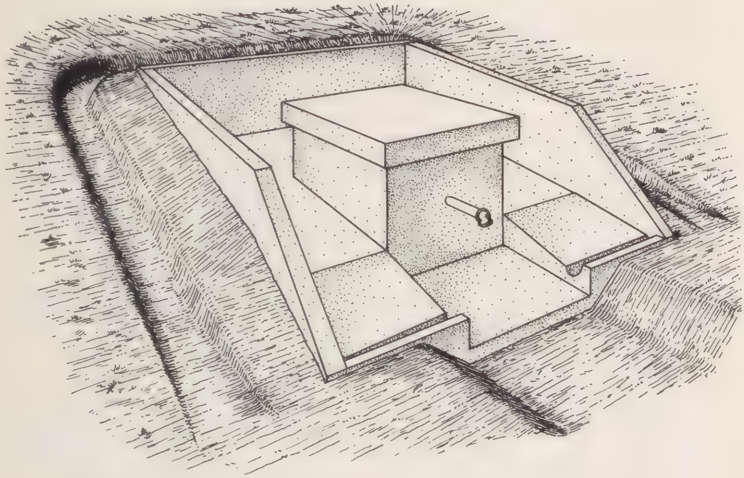
The area around the spring, especially on the uphill side, should be ditched and banked to divert rain water away from the spring.

Figs. 7 & 8

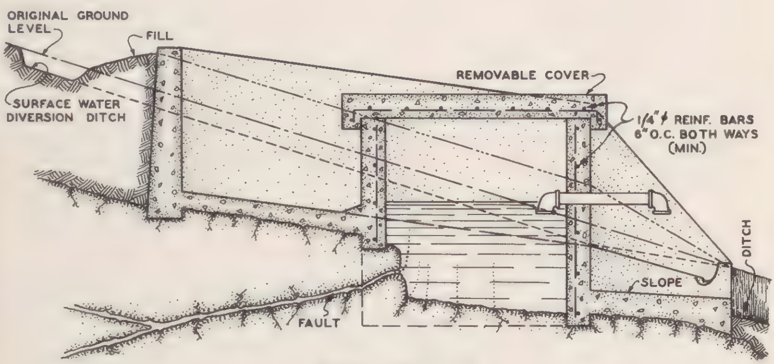
Figs. 7 & 8 show suggested methods of spring construction. Each spring is an individual problem and these plans must be modified to fit local conditions. Points to remember are that surface water must be shut off and that the water in the spring basin should not be made to rise above its normal elevation, else it may break out at some lower point and any work done will be lost.

Pump suction or gravity lines can be inserted where necessary while the concrete work is being done.

These illustrations show springs emerging from rock formation on a sloping hillside. Springs in flat sandy formations will require some changes in these plans. Often it may be necessary to construct the basin walls much deeper than shown here. Frequently a pump will be required to lift water to the surface. All spring basins should be covered.



GENERAL VIEW



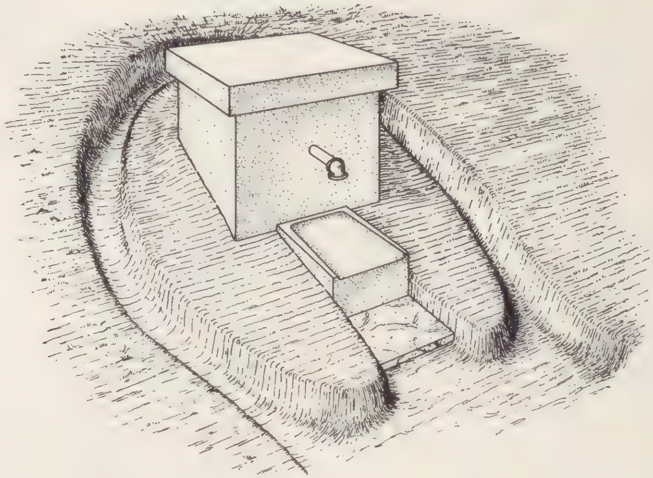
CROSS SECTION

PROTECTED SPRING SUPPLY

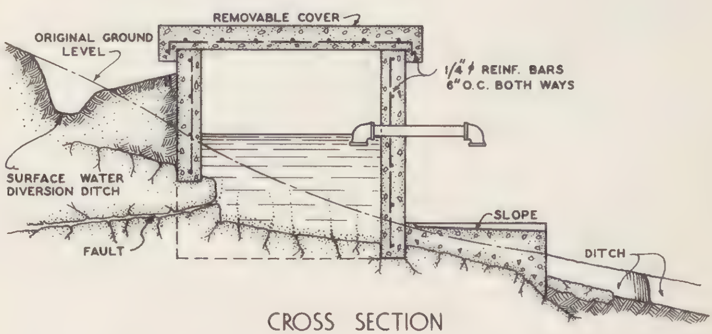
SHOWING

CONCRETE BASIN, COVER, RETAINING WALL & DIVERSION DITCH

FIG. 7



GENERAL VIEW



CROSS SECTION

PROTECTED SPRING SUPPLY

SHOWING

CONCRETE BASIN, COVER & DIVERSION DITCH

FIG. 8

SUGGESTED SPECIFICATIONS FOR CONCRETE WORK

Concrete used for well construction should be watertight. Sand and gravel or crushed stone which is clean, well graded from fine to coarse (not larger than 1 1/2 inches maximum size particles) and free from trash and clay, should be mixed with cement and water. This mixture should be 1 part Portland cement, 2 1/4 parts sand and 3 parts gravel or crushed stone. Not more than 6 gallons clean water should be mixed with 1 sack (cu.ft.) of Portland cement or 3/4 as much water as cement. More water dilutes the cement thereby reducing the strength and preventing the concrete from becoming water tight.

Sand and gravel from local creeks can be used if it is free of silt. Sand from a roadside ditch or from the surface of the ground should never be used.

MIXING CONCRETE - On a clean tight mixing platform (7 x 12 ft. for mixing a one sack batch) the measured quantity of sand is spread in a long oval pile and the measured quantity of Portland cement is distributed over the sand. This mixture is turned with square edged shovels from one end of the pile toward the other until its color is uniform. After again spreading the material in an oval pile the measured quantity of gravel or crushed stone is added and mixing is continued until this is also well distributed. Spreading this pile again in a long oval, a crater is formed in the pile and the measured quantity of water (not more than 3/4 as much water as cement in the batch) is poured into this crater. This mass is then carefully mixed, so that no water is lost, until the resulting concrete is mushy and plastic.

If the concrete produced from the proportions recommended is too stiff, the amounts of sand and gravel or stone should be reduced in making the next batch. If the concrete is too soft or soupy more sand or sand and gravel may be added. *Do not add more water.* All adjustments in the mixture should be in the sand and gravel or stone.

Concrete should be placed in the forms immediately after mixing and in no case later than 45 minutes after mixing as it then begins to harden and becomes unworkable.

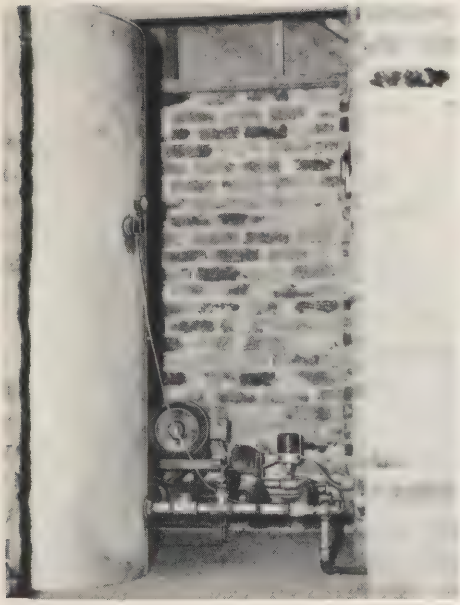
CURING - Concrete hardens and gains strength only so long as the original mixing water is retained, therefore, it is necessary that the concrete be kept wet for at least 7 days after it once hardens.

PUMPS

Selection of the proper type pump is most important. Due to the many types and designs of pumps available and the widely differing conditions under which they are to be used the prospective buyer should consult reputable pump agencies before making a purchase. The following information will be necessary to select the proper pump:

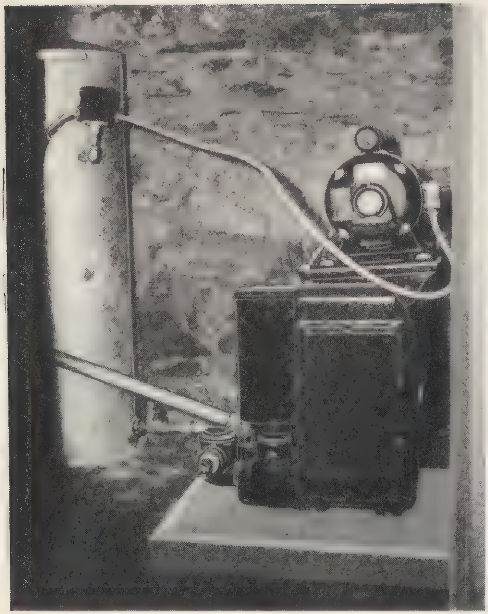
1. The kind of well, its depth, diameter, depth to low water level and if possible the amount of water the well will yield.
2. The kind of power to be used. (Hand, electric, windmill, gas engine).
3. The amount of water which will be required.
4. If the pump is to be located elsewhere than directly over the well, then the distance from the well to the pump location and the vertical height of this location above the low water level in the well is necessary.
5. The distance from the pump to the place where the water is to be used and the vertical height between the pump and the place where the water is to be used.

Piston pumps are more commonly used in wells than are other types of pumps. These are of two general classes, the so called shallow well or suction type and the deep well type.



Left - Shallow well type pump and pressure tank. Pump mounted in basement and suction line extends into well located outside of building.

Right - Hand pump mounted over dug well. Concrete slab and surrounding earth slopes away from well.



Left - Deep well pump and pressure tank. Pump mounted directly over well and above floor level. Casing extends into pump base.

Right - Jet type pump mounted over dug well. Frame house to be placed over installation.

The shallow well type may have the cylinder or working barrel built directly into the pump. It does not necessarily have to be located directly above the well but may be placed in a nearby basement or other building. In such installations suction lines should be as short as possible and all joints must be airtight. In order to prevent entrapping air in the suction line this should slope from the pump to the well.

The so called 'pitcher pump' is the cheapest and least satisfactory of all shallow well pumps. Its use is not recommended because it requires priming which frequently introduces contamination.

Deep well type pumps must be used when the water level is more than about 20 feet below the surface. The working barrel or cylinder is set in the water or near the water surface and the piston is operated by means of a sucker rod inside the drop pipe.

A weep hole about 1/16 inch in diameter drilled in the drop pipe above the cylinder but below the frost line, will permit water to drain from the upper part of the pump when not in use, thus preventing freezing in cold weather.

Hand operated deep well pumps may be used in wells not more than about 65 to 75 feet deep. In deeper wells power pumps are more satisfactory.

Pumps, other than piston type including centrifugal, air lift, air displacement, ejector or jet pumps or hydraulic rams may be advantageous in certain installations.

In the ejector or jet type pump a portion of the water discharged from a centrifugal pump is returned to the bottom of the suction pipe where by means of jet action more water is lifted to the pump. Such pumps are manufactured to work in wells of less than about 100 feet. They do not have to be mounted directly over the well.

CORROSION CONTROL

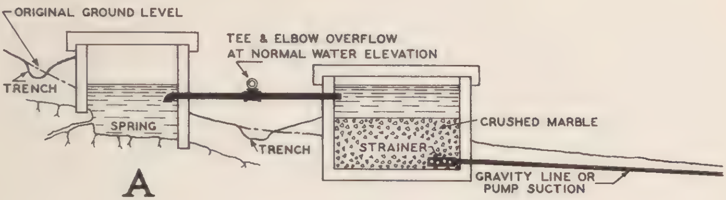
Waters from many wells and springs contain dissolved carbon dioxide in amounts sufficient to cause the water to attack iron or brass pipes, fittings and tanks. This shortens the life of plumbing, increases the pumping costs, produces a staining of bathroom fixtures and laundry and frequently imparts a metallic taste to the water.

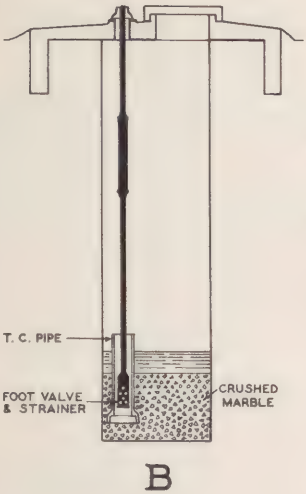
This condition can often be improved by removing the carbon dioxide. The simplest method for accomplishing this, in most cases, is to pass the water through a crushed marble contact bed. Such treatment causes an increase in the hardness of the water but due to the fact that most waters causing corrosion contain very little hardness originally a slight increase is to be preferred to the effects of corrosion.

Several methods may be employed for passing water through a marble contact bed. In some instances a pressure filter filled with fine marble may be installed on the discharge side of the pump. Such a filter should provide at least 5 minutes contact period. The crushed marble used in such installations is usually about the size of coarse sand.

In dug wells a layer of marble from 1 to 2 feet deep may be placed directly in the bottom of the well. This is also practical for some spring installations.

The marble used in such cases may vary from 1/4 to 1 inch in size. The accompanying diagrams show methods for using this treatment. Marble scraps can often be secured from local monuments works at small cost. The quarries in north Georgia can supply marble crushed to any desired size.

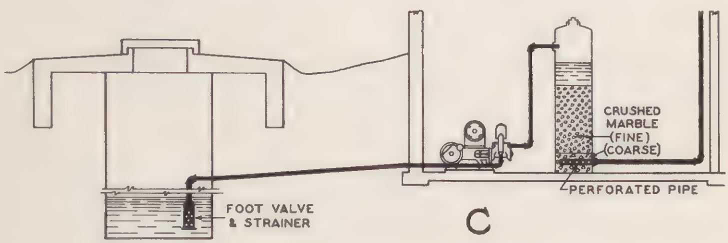




A - Shows a possible spring development. Water in the reservoir comes in contact with crushed marble before flowing or being pumped into the pipe system. Excess water overflows to waste before coming in contact with the marble.

B - Shows crushed marble placed in the bottom of a dug well. Marble chips ranging from 1/4 to 1 inch in size can be used in A & B.

C - Shows a pressure tank containing crushed marble. Water is pumped into the tank near the top, passes through the crushed marble and out through the bottom. A special tank is needed for such an installation. A layer of about 6 inches of marble or gravel from 1/4 to 1/2 inch in size is first placed in the bottom of the tank. On this is placed about two feet of marble the size of coarse sand. Complete units consisting of tank, valves, gravel and marble are marketed by certain commercial firms.



SUGGESTED METHODS OF TREATING WATER
TO PREVENT CORROSION
DUE TO CARBON DIOXIDE
FIG. 9

STERILIZATION

Water from a well or spring suspected of being polluted can be made safe by proper methods of sterilization. This, however, should be considered as a temporary measure *only*, where it is at all possible to construct the source of supply so as to eliminate further pollution.

Probably the most satisfactory method for the average home is to boil all water used for drinking and culinary purposes if it is suspected of being polluted. The water should be allowed to come to a full boil for a few minutes.

Another method is to treat the water in the well or spring with chlorinated lime. A sufficient amount should be added to give a faint taste of chlorine in the water 15 minutes after the chlorinated lime has been added. Usually about 1 ounce (a heaping tablespoonful) to 1000 gallons of water will be sufficient. The approximate amount of chlorinated lime to be used should be made into a thin paste and all lumps broken up, after which it can be dissolved in a gallon of water. This solution can be poured into the well or spring basin. Such sterilization should be carried out following any new construction or repair or cleaning operations on a water supply as invariably contamination will be introduced at such times. It is also useful in case of known accidental pollution of a water supply.

It should be borne in mind, however, that such sterilization is effective only so long as free chlorine exists in the water.

Water from a source known to be polluted at times but which is not subject to correction by construction methods should be sterilized by the continuous application of some chlorine compound to all water pumped. This is impractical for the average home due to the attention required by and cost of sterilizing equipment. At present this cost runs from $100 upward.

The following other important publications regarding sanitation are available to the public.

The Sanitary Pit Privy

The Sanitary Pit Privy Placard - Care and Maintenance

Septic Tank Systems for Suburban and Country Homes

The Story of Modern Water Supplies in Georgia

The Sanitary Drinking Fountain (Drawing)

Standard Screening Plans (Drawing)

Impounded Water Regulations (Malaria)

Malaria, History, Cause and Prevention

Drink Health Safely (Milk)

Milk from the Family Cow

Milk Borne Diseases and Bacteria Count of Milk

Mastitis in Dairy Herds

What Every One Should Know About Milk (U.S.P.H.S.)

Hygiene and Sanitation for the School Lunch Room

Public Health Mapping Standards

Essential Features of Camp Sanitation

Camp Sanitation Record (Inspection Data)